

NON-PUBLIC?: N  
ACCESSION #: 9011280139  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Duane Arnold Energy Center PAGE: 1 OF 6

DOCKET NUMBER: 05000331

TITLE: Reactor Scrams Following Removal of Potential Transformers  
EVENT DATE: 10/19/90 LER #: 90-019-00 REPORT DATE: 11/13/90

OTHER FACILITIES INVOLVED: None DOCKET NO: 05000

OPERATING MODE: N POWER LEVEL: 065

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR  
SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: Leonard L. Sueper, Technical Support Engineer  
TELEPHONE: (319) 851-7365

COMPONENT FAILURE DESCRIPTION:  
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED:

ABSTRACT:

On October 19, 1990 the reactor was in single loop operation at approximately 65% power, two night shift electricians assigned to the task of troubleshooting the source of an apparent fault on the 'B' Recirculation MG system drive motor pulled what they perceived to be the potential transformer for the circuit. The potential transformer actually senses the available supply voltage from one winding of the Startup transformer to one of the essential electrical busses. This caused the bus to sense an undervoltage condition and automatically initiated a dead bus transfer from the Startup Transformer to the Standby Transformer. When power was restored to 1A4, loss-of-power relays in the condensate demineralizer system (EEIS code SG), caused 3 out of 4 inservice demineralizer beds (function component FDM) to isolate. This resulted in the loss of feedwater and a reactor scram on low reactor vessel level.

The initiating event, removal of the potential transformer, was caused by personnel error. The root cause of the scram was an undesirable design feature of the condensate demineralizer control logic.

END OF ABSTRACT

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#### I. DESCRIPTION OF EVENT:

On October 19, 1990 the reactor was in single loop operation at approximately 65% power. The nonessential electrical busses (1A1 and 1A2) (EEIS code EA) were being powered by the Auxiliary Transformer which is energized by the main generator (EEIS code EL). The essential busses (1A3 and 1A4) were being powered by the Startup Transformer.

Work was in progress to return the 'B' Recirculation system motor-generator (MG) drive motor (EEIS code AD-MG) to service following the repair of an electrical fault. With the MG field breaker racked into a test position, the MG set was started whereupon the drive motor breaker tripped on what appeared to be a fault condition similar to that which

led to the discovery of the previous fault in the drive motor. Two night shift electricians assigned to the task of troubleshooting the source of the indicated fault had been directed (by their supervisor) to megger the drive motor and the cable-from the drive motor breaker to the motor. When the electricians failed to get conclusive megger readings at the breaker they decided to pull what they perceived to be the potential transformer (component function identifier PT) for the circuit before remeggering the cable. Though located above the breaker cabinet and identified with a small metal shipping tag embossed with the breaker number, the potential transformer actually senses the available supply voltage from the 'X' winding of the Startup transformer to the 1A2 and 1A4 busses (a different, 'Y', winding on the Startup Transformer is available to supply power to the 1A1 and 1A3 busses).

At 2213, upon notifying the control room operator of their intentions, the electricians pulled the potential transformer from its cabinet. This caused the 1A4 bus to sense an undervoltage condition and automatically initiated a 'slow' dead bus transfer from the Startup Transformer to the Standby Transformer. The slow (5 sec.) transfer is designed to allow time for any faulted loads on the bus to trip in case the indicated fault was not on the transformer. The indicated undervoltage condition caused the 'B' Standby Diesel Generator (EEIS code EK) to start (but was not required to close on the 1A4 bus because of the successful transfer of 1A4 from ' the Startup Transformer to the Standby Transformer). Also, a 'B' Reactor Protection System (EEIS code JC) channel trip took place due

to the momentary interruption in power. When power was restored to 1A4, loss-of-power relays in the condensate demineralizer control logic (EEIS code SG), which is ultimately powered from the 1A4 bus, caused 3 out of 4 inservice demineralizer beds (function component FDM) to isolate. A reactor feed pump trip occurred due to the isolation of all but one of the beds.

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The remaining feedwater pump was unable to maintain level despite attempts to reduce reactor power by reducing recirculation flow.

At 2214, the reactor scrambled on low vessel level just as the operators were about to manually scram the reactor. With two condensate pumps and only one feedwater pump running, the 'A' condensate pump was secured manually per procedure after which the 'B' feedwater pump also tripped on low suction pressure. By 2215, the condensate demineralizer bed bypass line was opened and the 'A' feedwater pump was restarted.

At 2217, a main generator reverse power condition caused the Auxiliary Transformer to attempt a closed transfer of the 1A1 and 1A2 nonessential busses to the Startup Transformer in anticipation of the Main Generator (EEIS code TB) trip on reverse power. However, because of the under voltage indication on the Startup Transformer, only 1A1 successfully transferred. At 2219, a Main Generator trip occurred on reverse power which deenergized the 1A2 bus. As a result, the remaining ('B') condensate pump lost power and the remaining ('A') feedwater pump tripped on low suction pressure. By this time reactor level had been restored and the scram was reset.

Vessel level slowly decreased while steps were taken to restart the 'A' condensate pump and 'A' feedwater pump. At 2247, when it appeared feedwater would not be restored before level dropped to the scram setpoint, the Reactor Core Isolation Cooling (RCIC) (EEIS code BN) system was manually initiated to restore vessel level. RCIC had not begun to inject before a reactor scram occurred again on low level. RCIC was operated for approximately 6 minutes to restore level. At that time the 'A' Feedwater pump was restarted and RCIC was secured.

#### OTHER ITEMS NOTED

Following the first scram, EOP-ATWS was conservatively entered because three control rods over-traveled past the full-in position so that their positions could not, be positively verified. When the scram was reset the flow of scram water ceased, allowing the control rods to drift back into their full in position at which time EOP-ATWS was exited.

When power was restored to 1A4 following the open bus transfer, the current inrush was sufficient to trip breaker 1B4223. Among the loads supplied by 1B4223 are the SRM and IRM (EEIS code IG) drive motors, the control room radio, a portion of the plant paging system, and an optical link on the plant phone system. As a result the SRMs and IRMs were not inserted into the core immediately following the scram and the control room operators were not able to use the radio. Also, because of the lost optical link, the plant phone system temporarily lost the ability to send

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or receive most offsite calls. The degradation in the control room's communication capabilities were sufficient for the shift supervisor to declare an Unusual Event (EAL A-25). The control room possessed sufficient backup telephone lines to make the required notifications within the required time. The loss of the portions of the plant page hampered the mobilization of operations personnel in recovering from the scram.

The 'A' recirculation pump tripped, apparently due to low lube oil pressure when 1A2 became deenergized. A lube oil pump energized from 1A2 lost power and the standby lube oil pump did not automatically start because the pump start logic is based on the position of the pump breaker contacts.

An operator in the pump house observed that when power to 1A2 was lost the 'B' circulating water (EEIS code NN) pump lost power and was observed rotating backwards with the air actuated discharge valve open. The reason the discharge valve did not close on loss of power is presently unknown. Preliminary testing of the discharge valve was performed which did not yield an explanation and the pump was eventually restarted. Vibrational analysis performed on the pump did not indicate degradation.

The cause of the recirculation pump drive motor trip that the electricians were originally troubleshooting was found to be due to the incorrect position of the MG field breaker when the MG set was test started. To place the breaker in the test position it is partially removed from its cubicle such that only some of the breaker fingers are engaged. This allows the MG set to go through its entire startup sequence up to the point of closing the output breaker to the recirculation pump motor.

Test starting this equipment has historically been troublesome because there is no positive indication when the breaker has been racked into its test position.

## II. CAUSE OF EVENT

The initiating event, removal of the potential transformer, was caused by personnel error. The electricians based their decision to pull the potential transformer on the previous experience of one of the electricians who remembered being directed to pull the potential transformers at other breakers prior to meggering during the latest refueling outage. The electricians failed to verify their decision by reviewing plant electrical drawings or consulting fully with supervisory personnel prior to taking action. However, while the personnel error did initiate the event and later complicated the recovery from the scrams, the effects to the plant as a result of removing the potential transformer should not have led to a reactor scram.

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Plant procedures specify that maintenance troubleshooting activities be planned activities. However, limitations on the scope of work that troubleshooting may include and definitions on the level of planning that is required prior to troubleshooting were too vague.

The root cause of the scram was a design problem with the condensate demineralizer control logic. The loss-of-power relays were directly responsible for the loss of feedwater transient and reactor scram following the interruption in power to 1A4. The loss-of-power relays in the condensate demineralizer logic was intended to prevent a resin intrusion following a loss of power to the condensate system. However, because the logic is powered from a different power supply than the condensate system, the logic cannot detect the loss of power to the condensate system.

## III. ANALYSIS OF EVENT

A loss of feedwater transient such as the one that occurred falls within previous accident analyses. All ECCS equipment was operable and capable of injection into the vessel. The additional complications that occurred during this event did not jeopardize a safe shutdown of the plant.

## IV. CORRECTIVE ACTIONS

Several corrective actions were identified.

1. An interim change to the plant operating procedures has been initiated and will be fully implemented by December 20, 1990 which will bypass the loss-of-power relay in the condensate demineralizer

logic.

2. Plant modifications to further enhance condensate operation shall be developed and implemented prior to startup following the 1992 refueling outage.

3. Maintenance returned the 'B' recirculation system to service.

4. The electricians who pulled the potential transformer were counseled about the event.

5. Plant electricians will receive continuing training on protective relaying by December 31, 1990.

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6. All maintenance personnel were briefed on this event and plant electricians received additional instruction relating to potential transformers prior to returning to work. Management also issued a division-wide policy statement encouraging employees to identify decision-making processes that do not receive second-party review.

7. Maintenance has changed the work control procedures to better define workscope and level of planning required.

8. Hazard/warning labels will be attached to drawer mounted potential transformers in the plant to alert workers of the consequences by June 7, 1991.

9. Operations personnel were briefed on the requirements for restoring power to 1B4223 loads to service following a breaker trip.

10. An evaluation shall be performed on 1B4223 and the lighting panels it supplies to determine the proper size for the loads they carry. The evaluation will be completed by March 30, 1991.

11. Additional guidance on performing test starts of the recirculation pump MG sets will be developed by December 31, 1990.

12. A design change to route a backup power supply to the optical telephone link will be installed by January 31, 1991.

13. The cause of the failure of the 'B' circulation water pump discharge valve to close will be determined during the 1992 refueling outage due to the need to work during an extended plant shutdown.

## V. ADDITIONAL INFORMATION

1. A review of the LER database revealed previous instances where 1A4 became deenergized. In each case the events happened during plant shutdown when the effects of the condensate demineralizer logic did not make themselves obvious.
2. This event is being reported pursuant to 10CFR50.73(a)(2)(iv).

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Iowa Electric Light and Power Company

November 13, 1990  
DAEC-90-0952

Mr. A. Bert Davis  
Regional Administrator  
Region III  
U. S. Nuclear Regulatory Commission  
799 Roosevelt Road  
Glen Ellyn, IL 60137

Subject: Duane Arnold Energy Center  
Docket No: 50-331  
OP. License DPR-49  
Licensee Event Report #90-019

Gentlemen:

In accordance with 10 CFR 50.73 please find attached a copy of the subject Licensee Event Report.

Very truly yours,

Rick L. Hannen  
Plant Superintendent - Nuclear

RLH/BKS/pwj

cc: Director of Nuclear Reactor Regulation  
Document Control Desk  
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File A-118a

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